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CONCEPTUAL FRAMEWORK FOR EFFECTIVE IMPLEMENTATION OF 'PROJECT MANAGEMENT INSTITUTE'S STANDARD FOR EARNED VALUE MANAGEMENT' IN SRI LANKA

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ABSTRACT

Successful accomplishment of a project requires effective management of its performance. The performance of the most construction projects is tracked utilizing planned cost vs. actual cost measures only. Earned Value Management (EVM) technique came into existence as an effective performance measurement and a feedback tool for managing projects by emphasizing more on the Earned Value (EV) of projects. Regardless of the immense benefits of EVM, there are significant deficiencies in the process of implementation of the EVM technique in Sri Lanka. Therefore, this study aims to develop a conceptual framework for effective implementation of EVM in the Sri Lankan construction industry with specific reference to the Project Management Institute's (PMI's) standard for EVM. A qualitative research approach was used to accomplish the aim of the study. The empirical findings were analyzed using the manual content analysis technique to determine the degree of implementation of the PMI's standard for EVM in Sri Lanka. The deficiency of professionals and inadequate conceptual knowledge were identified as the most critical barriers associated with the implementation process of the EVM technique. Allocating a separate team to execute the EVM technique, arranging short courses on EVM, developing a standard master format for project performance measurement are the measures that this study recommends promoting the adoption of the EVM technique in the Sri Lankan construction industry.

Keywords: *Earned Value Management; Performance Measurement; Project Management Institute; Standard.*

1. INTRODUCTION

Criteria of the construction project's success have constantly enriched in project management context (Chan and Chan, 2004). Thus, the performance of a construction project has been judged using different traditional approaches to get a better picture of the project's status (Khan *et al*., 2011). However, those Project Management tools did not withstand the expected level (Soloman, 2002). As a result of the multidisciplinary effort of researchers, EVM emerged as a useful Project Management tool (Bhosekar and Vyas,

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2012). EVM is a technique that can be applied to the management of all capital projects, in any industry, while employing any contracting approach (Fleming and Koppelman, 2002). With the adaptation of EVM to construction project management, the project team can modify the cash flow, update financial reports, figure out the schedule status of a project, capture work progress against the baseline and evaluate the health of the project along with its life cycle in a timely manner (Kim *et al*., 2003).

Sri Lankan construction industry is well in need of a well-known and established performance monitoring technique for the development of the sector and its better performance (Ekanayake *et al*., 2018). This research aims to develop a conceptual framework for effective implementation of the EVM technique in the Sri Lankan construction industry, with specific reference to the PMI's standard for EVM. EVM, which is a new performance measurement technique, was initially developed in the United States, and it has been minimally addressed in the literature of the Sri Lankan context (Hettipathirana and Karunasena, 2014). However, a few researchers had studied the feasibility of adopting a standard for the implementation of EVM in the Sri Lankan construction industry (e.g. Nimashanie and Perera, 2013; Wickramasooriya *et al*., 2017). As far as the Sri Lankan context is concerned, the potential impediments and solutions to such matters during the implementation of the PMI's standard have not been explicitly addressed. Thus, there is a research gap towards developing a conceptual framework for effective implementation of the EVM technique considering the adaptability of the PMI's standard for EVM in the Sri Lankan context. The potential of applying the PMI's standard for EVM in achieving construction project success could grow once a conceptual framework is established concerning the deficits mentioned above. When considering to implement the EVM technique within the Sri Lankan context by adopting the PMI's standard, the following constituents were identified as crucial to be investigated: (1) the contemporary practices of performance measurement in Sri Lanka; (2) the degree of implementation of the PMI's standard in local construction firms; (3) challenges that can be anticipated; and (4) the potential solutions to successfully address those challenges through the PMI's standard for EVM.

2. LITERATURE REVIEW

2.1 THE PMI'S STANDARD FOR EVM

As a performance measurement methodology, EVM adds some critical practices to the project management process. These practices occur primarily in the areas of project planning and control and are related to the goal of measuring, analyzing, forecasting, and reporting cost and schedule performance data for evaluation and action by workers, managers, and other key stakeholders (PMI, 2005). EVM synthesizes best results in initiating, planning, executing, monitoring and controlling phases in the project by breaking down work packages, developing proper performance baselines and incorporating those to review in a systematic manner (Willems and Vanhoucke, 2015). Clear project scope is required with a project budget and a project schedule to implement EVM concepts. The project budget must reflect all planned costs incurred by the activities of which the project consists (Buyse and Vandenbussche, 2010). EV measuring techniques must be established for each type of event before carrying out project monitoring work (Dissanayake, 2010). In the project execution process, EVM requires that physical work progress be assessed and budgetary EV be credited as prescribed in

the project management plan (PMI, 2005). The significant steps of the PMI's standard for EVM can be summarized as follows.

I. Establish a Performance Measurement Baseline (PMB)

1. Decompose work scope to a manageable level
2. Assign unambiguous management responsibility
3. Develop a time-phased budget for each work task
4. Select EV measurement techniques for all functions
5. Maintain the integrity of PMB throughout the project

II. Measure and analyze performance against the baseline

6. Record resources usage during project execution
7. Objectively measure the physical work progress
8. Credit EV according to EV techniques
9. Analyze and forecast cost/schedule performance
10. Report performance problems and/or take actions

2.2 THE CONTEMPORARY PRACTICES OF PERFORMANCE MEASUREMENT APPLICATION IN SRI LANKA

In the Sri Lankan construction industry, there is a strong need for a globally established performance monitoring technique for the development and better performance of the sector (Nimashanie and Perera, 2013). Unfortunately, there is no specific method that has been identified so far as well. Performance evaluation in the construction industry is thus carried out using the results of diverse applications such as S curves, Gantt charts, Cash flow statements, and EVM (Wickramasooriya *et al*., 2017). Hence, no established or recognized standard is available for project performance evaluation in Sri Lanka, the success or failure of the projects often depends on rather traditional methods, which are disadvantageous as well as obsolete compared to EVM (Hettipathirana and Karunasena, 2014). Regrettably, in the Sri Lankan context, EVM had not gained any attention or importance otherwise (Ekanayake *et al*., 2018). Thus, it can be concluded that the management and control of cost and schedule are in the primary stage in Sri Lanka (Bowen *et al*., 2012). Despite all the held facts, the existing literature on EVM is also minimal concerning the Sri Lankan context. Ekanayake *et al*. (2018) had solitarily conversed some general barriers in implementing EVM concepts in Sri Lanka as stipulated in Table 1.

Table 1: Obstacles in implementing EVM in Sri Lanka

Barriers	Status
EVM performance	EVM covers a large area with limitations within Sri Lankan projects, and Employees are not interested in doing additional work as well.
The struggle of Employees	Lack of hard bondage between employees and management which results in the absence of adherence of EVM in their projects.
Cost factor	Most of the project managers are not ready to accept risks related to new technology with the note of high cost involved in the implementation of EVMS in a project.
Time duration	Due to the lack of expertise in the industry, a long period is required to acquire the mandatory knowledge and skills in the EVM software.

Barriers	Status
Accuracy of data	Lack of reliable data in the construction industry is a significant hindrance which requires regular monitoring to acquire them for productive implementation of EVM.
Lack of awareness on EVM	Most of the employees are not compatible with EVMS due to their lack of knowledge.
Fear for language	Lack of fluency in English acts as a hindrance for the employees to embrace and utilize EVM in the Sri Lankan context.
Minimum support from the top management	Some managers are reluctant to share their knowledge with the middle and lower-level employees, who may be the cause for negative attitudes in new implementations.
Technical issues	Since Sri Lanka lacks the technical facilities required, computer literacy, physical and human resources should be made available for a project to implement EVMS.
Demotivation of employees	Motivation and encouragement are required within the employees for the implementation of EVMs; however, within the Sri Lankan context, demotivation appeared to be a considerable barrier for the EVM implementation.

Source: Ekanayake *et al.* (2018)

3. RESEARCH METHODOLOGY

Research approach can be constructed as a general plan of how the researcher will go about answering the research question (Tan, 2002). Since the use of PMI's standard for EVM is confined to a limited area and also among only a handful of experts, the qualitative research approach was utilized to obtain data from the experienced practitioners in the industry. It was required to obtain information on the contemporary performance measurement practices and the degree of application of the EVM technique with particular reference to the PMI's standard in Sri Lanka. Accordingly, the opinions of practitioners concerning the current stance in the industry in terms of adopting the PMI's standard for EVM, potential challenges that may be encountered and the solutions that may be given via the PMI's standard were recognized. The qualitative data were contributed by a number of thirteen industry experts who are veterans when it comes to their level of experience in the construction industry as well as the profound knowledge of the EVM concepts shaped by enormous passion. Majority of them are professionals with an experience of more than twenty years, holding managerial positions within their respective organizations. The manual content analysis method was utilized in the data analysis. A brief sketch of the interviewees' profiles is illustrated in Table 2.

Table 2: The profile of the interviewees

Interviewee Code	Designation	Profession	Experience
Interviewee - 1	Chief Executive Officer	Chartered QS	25 years +
Interviewee - 2	Chief Executive Officer	Chartered QS	25 years +
Interviewee - 3	DGM – Contracts and Estimation	Chartered QS	12 years +
Interviewee - 4	Contracts Manager	Chartered QS	10 years +

Interviewee Code	Designation	Profession	Experience
Interviewee - 5	Director	Chartered QS	45 years +
Interviewee - 6	Contracts Manager	Chartered QS	15 years +
Interviewee - 7	AGM - Construction	Project Manager	35 years +
Interviewee - 8	AGM - Construction	Project Manager	25 years +
Interviewee - 9	Executive Senior QS	Chartered QS	20 years +
Interviewee – 10	Director - Projects	Chartered QS	30 years +
Interviewee – 11	Executive QS, who is passionate about the EVM technique	QS	2 years +
Interviewee – 12	PhD Candidate	QS	2 years +
Interviewee – 13	Associate Director – Projects	Project Manager	15 years +

4. DATA ANALYSIS, FINDINGS AND DISCUSSION

4.1 THE DEGREE OF IMPLEMENTATION OF EVM RELYING ON PMI'S STANDARD IN SRI LANKA

A thorough observation of the empirical findings revealed that there is a deficiency of a specific standard performance measurement application in Sri Lanka. Thus, the issue resulted in the practitioners to deal with several traditional project performance measurement techniques. Even though Sri Lanka is deprived of an EVM standard, it was identified that, for several decades, the industry had slight exposures to the EVM technique. Since the necessity of having a recognized standard as PMI to implement the EVM technique within the local construction industry was apprehended through the empirical findings. It was concluded that the PMI's standard had not been recognized by the practitioners to implement the EVM concepts yet. Subsequently, it was determined that only a few steps of the EVM process had been highly implemented in Sri Lanka, relying on the PMI's standard. The implementations are instead a set of steps adjusted to meet the organizational requirements in traditional project management procedure, rather than a developed or accurately standardized practice. Most of the key steps of the PMI's standard were identified as moderately performed steps in the construction industry of Sri Lanka. However, it was recognized that they were also not explicitly implemented with respect to a distinct performance measurement standard as PMI, but merely as generic project management formalities of the traditional project management practices of Sri Lanka. All the industry experts referred to two of the key steps of PMI's standard for EVM system as the least implemented steps in the local construction industry.

Each key step of PMI's standard based EVM was determined to establish its degree of implementation in the local construction industry, according to the knowledge and experience of experts. The significance of enhancing the traditional performance measurement practices to a new performance measurement standard, such as the PMI's standard based EVM concept, in the construction industry of Sri Lanka was stressed by the empirical findings.

The degree of implementation of key steps of the PMI's standard for EVM can be summarized as shown in Table 3.

Table 3: The degree of implementation of PMI's standard for EVM

Key Steps of the PMI's Standard for EVM	Degree of Implementation
Step 01 - Decompose work scope to a manageable level	Highly implemented but with several deviations to the standard practice of PMI's standard for EVM
Step 02 - Assign unambiguous management responsibility	Moderately performed; not individually as a critical step of EVM technique relying on PMI but as generic project management procedural
Step 03 - Develop a time-phased budget for each work task	Highly implemented but with several deviations to the standard practice of PMI's standard for EVM
Step 04 - Select EV measurement techniques for all functions	Least implemented in the local construction industry
Step 05 - Maintain the integrity of PMB throughout the project	Moderately performed; not individually as a critical step of EVM technique relying on PMI but as generic project management procedural
Step 06 - Record usage of resources during project execution	Highly implemented but with several deviations to the standard practice of PMI's standard for EVM
Step 07 - Objectively measure the progress of physical work	Moderately performed; not individually as a critical step of EVM technique relying on PMI but as generic project management procedural
Step 08 - Credit EV according to EV techniques	Least implemented in the local construction industry
Step 09 - Analyse and forecast cost/schedule performance	Moderately performed; not individually as a critical step of EVM technique relying on PMI but as generic project management procedural
Step 10 - Report performance problems and/or take actions	Moderately performed; not individually as a critical step of EVM technique relying on PMI but as generic project management procedural

4.2 THE CHALLENGES TO BE ENCOUNTERED AT THE TIME OF IMPLEMENTING EVM IN SRI LANKA

The empirical findings acknowledge that, when compared with PMI's standard for EVM, numerous nonconformities exist in contemporary project performance measurement practices in Sri Lanka. The definite necessity of having a conceptual framework to implement the EVM technique relying on PMI's standard was determined for the context of Sri Lanka. Considering the rigour involved in the introduction of a new performance measurement standard, the industry experts were interviewed to obtain awareness about the potential and predictable challenges during the implementing EVM concepts based on the PMI's standard. The industry experts highlighted numerous challenges as per the context of Sri Lanka. The most significant challenges which were highlighted by the

majority of the experts are stipulated in Table 4 concerning each key step of the PMI's standard for EVM.

Table 4: Most significant challenges to be encountered

Key Steps of the PMI's Standard for EVM	Most Significant Challenges
Step 01 - Decompose work scope to a manageable level	UK Based BOQ system in Sri Lanka being unsupportive to decompose WBS and OBS as a program-based system
Step 02 - Assign unambiguous management responsibility	Lack of enough staff at the inception of the projects in Sri Lanka
Step 03 - Develop a time-phased budget for each work task	Shortage of skilled professionals to execute the task
Step 04 - Select EV measurement techniques for all functions	Insufficient knowledge of the project management personnel on EV
Step 05 - Maintain the integrity of PMB throughout the project	The high cost of maintenance and time consumption
Step 06 - Record usage of resources during project execution	Lack of proper record keeping in the local construction industry
Step 07 - Objectively measure the progress of physical work	Lack of exact benchmarks to measure the progress of physical work
Step 08 - Credit EV according to EV techniques	Insufficient knowledge to execute the EVM technique relying on the PMI's standard
Step 09 - Analyse and forecast cost/schedule performance	Lack of real-time progress feedbacks during the project
Step 10 - Report performance problems and/or take actions	Fear of failure / Top management pressure

4.3 SOLUTIONS TO OVERCOME THE CHALLENGES

For the effective implementation of EVM system as performance measurement and monitoring tool in Sri Lanka, the above-identified problems should be mitigated by controlling or embracing them by minimizing the undesirable impact on the local construction industry. The essential solutions should be proactively performed to overcome the challenges above, relying on the PMI's standard for EVM. Hence, the answers and the mitigation measures were concluded through the empirical findings. These solutions were contributed to creating a pathway to develop the conceptual framework for effective implementation of the EVM technique in the construction industry of Sri Lanka. The experts had made a significant contribution in recognizing the necessary proactive measures for the challenges documented concerning each key step of the PMI's standard as detailed in Table 5.

Table 5: The solutions to overcome the challenges

Key Steps of the PMI's Standard for EVM	Most Significant Challenges	Most Significant Solutions
Step 01 - Decompose work scope to a manageable level	UK Based BOQ system in Sri Lanka being unsupportive to	Development of formats, steps, and processes to convert existing BOQ

Key Steps of the PMI's Standard for EVM	Most Significant Challenges	Most Significant Solutions
	decompose WBS and OBS as a program-based system	system into program - based system with resources
Step 02 - Assign unambiguous management responsibility	Lack of enough staff at the inception of the projects in Sri Lanka	Appointing a well-equipped team with knowledge and technical know-how at the earliest possible
Step 03 - Develop a time-phased budget for each work task	Lack of skilled professionals to execute the task	Development of a duly prepared construction program
Step 04 - Select EV measurement techniques for all functions	Insufficient knowledge of the project management personnel on EV	Implementation of the EVM technique relying on PMI's standard for EVM to suit for Sri Lanka
Step 05 - Maintain the integrity of PMB throughout the project	The high cost of maintenance and time consumption	Implementation of a web-based information sharing system
Step 06 - Record usage of resources during project execution	Lack of proper record keeping in the local construction industry	Formation of an online collaborative system that enables live updates
Step 07 - Objectively measure the progress of physical work	Lack of exact benchmarks to measure the progress of physical work	Derive a scientific method in undertaking the tasks
Step 08 - Credit EV according to EV techniques	Insufficient knowledge to execute the EVM technique relying on the PMI's standard	Educate the professionals on EVM and EV measurement techniques based on PMI's standard for EVM
Step 09 - Analyse and forecast cost/schedule performance	Lack of real-time progress feedbacks during the project	Development of skills and competencies of QSs and Project Management professionals which would be benefited in the project performance measurement
Step 10 - Report performance problems and/or take actions	Fear of failure / Top management pressure	Identify how beneficial the application of the EVM system to the organization is and allocating the maximum support from the top management to implement the EVM process

A conceptual framework was developed based on the literature findings and empirical findings to conquer the aim of this research. The significant areas to be concerned about when implementing the EVM technique as a project performance measurement technique by adopting the popular PMI's standard for EVM, have been profoundly articulated within the conceptual framework (refer Figure 1).

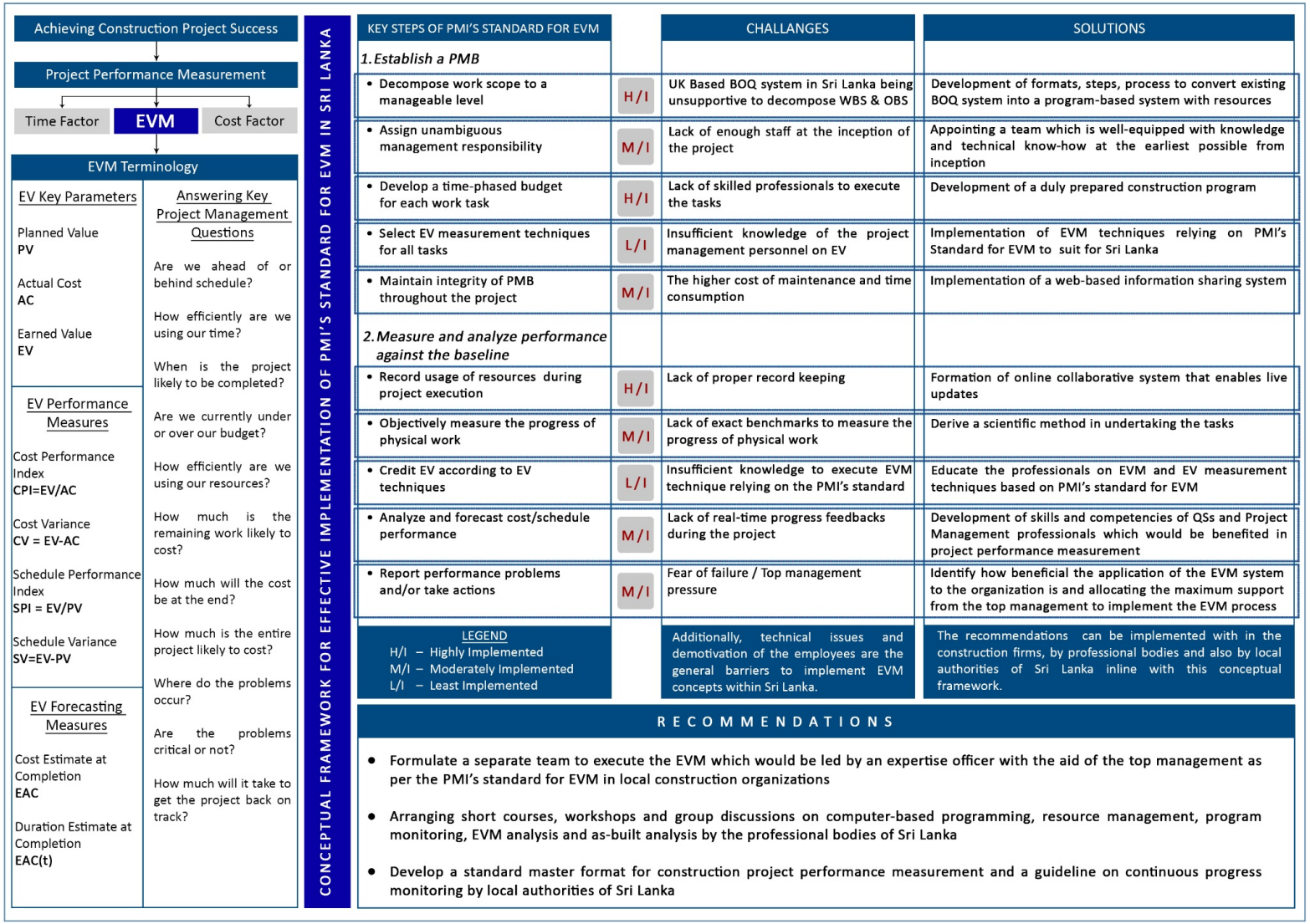

Figure 1: Conceptual framework

5. CONCLUSIONS AND RECOMMENDATIONS

The proposed framework can act as a novel yet a significant EVM tool for the stakeholders who intend to apply the EVM technique, with particular reference to the PMI's standard. It holds the potential of motivating the stakeholders with an accurate account of what they would encounter during the process of performance measurement in construction projects of Sri Lanka. The conceptual framework enables EVM stakeholders to improve the effectiveness and efficiency of the entire performance measurement and feedback processes. However, the research is limited by the fact that the conceptual framework only counts on the PMI's standard whereas there are other standards alike ANSI/EIA standard, 748-A guidelines published by National Defense Industrial Association (NDIA), AS4817 published by Australian standards committee to implement the EVM technique. Hence, as illustrated in Figure 1, paying attention and adherence to the conceptual framework will substantiate and uplift the traditional project performance measurement practices to a higher level by reaping the maximum benefits in terms of the grooming construction industry of Sri Lanka.

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